second flame being ignited, the temperature rises to 62°·88, thus increasing the differential temperature to 2°·88. The ignition of the third flame augments the differential temperature to 3°·80. The remaining flames being ignited in regular order downwards, their combined radiant energy elevates the temperature to 67°·90. Deducting the temperature of the enclosure *c* (60°), the trial shows that although the single flame at the maximum distance from the bulb, is capable of producing a differential temperature of 1°·76, the energy of the *ten* flames together produces only 7°·90. This fact furnishes conclusive evidence of the imperfect transparency of the flames. Assuming that the heat rays are capable of passing freely through the incandescent medium, it will be perceived that the entire series of flames should produce a differential temperatue of 1·76×10=17°·60, showing a retardation of 17·6−7·9=9°·7. And if we take into account the diminished distance of the lower flames from the bulb of the thermometer, it will be found that the actual retardation greatly exceeds this computation. We have thus demonstrated that flames are most transparent, as supposed by Père Secchi. Consequently, the inferences drawn from the experiment to which the distinguished *savan* refers in his letter to the French Academy of Sciences are wholly unwarrantable.

Having disposed of the question of transparency, and ascertained the degree of temperature communicated to the thermometer by the radiant energy of the flames alone, let us now suppose that the instrument has been turned towards the sun. The temperature produced by the combined energy of solar radiation, and the radiation of the flames, after directing the instrument towards the luminary, will be found recorded in the fifth column of the table. Our space not admitting of a detailed statement, we must dispense with an examination of the energy transmitted for each flame separately, and at once consider the effect produced by passing the sun's rays through the entire series. It has already been stated that the radiation of all the flames combined imparts a differential temperature of 7°·90 to the thermometer. By reference to the table it will be seen that, the temperature produced by the sun's rays is 21°·69 when the flames are extinguished.* Consequently the temperature, after lighting the whole series, ought to be 21·69+7·90=29°·59, since solar heat, under analogous conditions, is capable of increasing definitely the temperature of substances whatever be their previous intensity.† Referring again to the table, it will be found that the maximum increase of temperature attending the passage of the comparatively cold solar rays through the incandescent gas, is 2°·31, while the radiant energy of the flames produces a differential temperature of 7°·90. This extraordinary discrepancy points to an increase of molecular energy within the incandescent gas, notwithstanding its temperature being fully 1,900° higher than that produced by the sun's radiant heat.

J. ERICSSON

The Instrument turned from the Sun.			The Instrument directed towards the Sun.		
Number of flame from the top.	Distance of flame from bulb.	Temperature produced by radiation of the flames.	The sun's rays acting directly on the bulb.	The sun's rays passing through the flames.	Increment of temperature attending the passage of the solar rays through the flames.
	Inches.	Deg. Fah.	Deg. Fah.	Deg. Fah.	Deg. Fah.
1	24·8	1·76	21·60	21·90	0·30
2	23·8	2·88	21·61	22·20	0·59
3	22·8	3·80	21·62	22·49	0·87
4	21·8	4·58	21·63	22·75	1·12
5	20·8	5·24	21·64	22·99	1·35
6	19·8	5·84	21·65	23·22	1·57
7	18·8	6·38	21·66	23·43	1·77
8	17·8	6·91	21·67	23·63	1·96
9	16·8	7·42	21·68	23·82	2·14
10	15·8	7·90	21·69	24·00	2·31

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* Notwithstanding the low temperature indicated by the thermometer of the experimental apparatus, 21°·69, the actual solar intensity during the investigation, ascertained by the actinometer, has at no time been less than 50°, a very instructive fact proving the futility of attempting to measure solar intensity by thermometers the bulbs of which are exposed to the refrigerative action of surrounding air. For the purpose in view, however, that of measuring the comparative radiant power of flames and solar heat, the unavoidable exposure of the bulb to atmospheric influence, is unimportant, provided the enclosure be kept at a constant temperature during the experiments.

† Père Secchi reminds us, in "Le Soleil," that Mr. Waterston found by his solar intensity apparatus, that, when the thermometer was enclosed in a heated vessel imparting upwards of 400° Fah. to the bulb, the same degree of differential temperature was reached by exposure to the sun, as when a cold enclosure was employed which reduced the indication of the enclosed thermometer to that of ordinary atmospheric temperature.

NOTES

MR. DARWIN'S forthcoming work on "Expression in Man and Animals" bids fair to be of a more popular character than any of his other publications. It will commence with a statement of the general principle of Expression;—that serviceable actions become habitual in association with certain states of the mind, and are performed, whether or not of service, in each particular case. This will be illustrated in the case of expression of the various emotions in man and the lower animals. The means of expression in animals will then be discussed, and the special expressions of animals and man, such as the depression of the corners of the mouth in grief, frowning, the firm closure of the mouth to express determination, gestures of contempt, the dilatation of the pupils from terror, the causes of blushing, &c. In conclusion, the bearing of the subject will be spoken of on the specific unity of the races of man, the part will be discussed which the will and intention have played in the acquirement of various expressions, and the question of their acquisition by the progenitors of man will be referred to. Seven heliotype plates reproduced from photographs will illustrate the work.

HISTORY is said to repeat itself. It is singular to find that six months ago the colony of Victoria was involved in a similar controversy to that which has recently agitated the scientific world at home. Baron Friedrich von Mueller is the Dr. Hooker of Australia. The Botanic Gardens at Melbourne have become under his management as truly scientific an institution as those at Kew, and their Director has performed similar eminent services both to the colony and to the mother country in spreading a knowledge of the value of the indigenous vegetable products of Australia. After twenty years' service, however, it is discovered that von Mueller is "not a landscape gardener," and an agitation is set on foot—we do not, however, hear that it originates in the Board of Works, if there is such a department in Victoria, nor do we know who is the Ayrton of the Antipodes—to deprive him virtually of the control of the Botanic Gardens. Next to the removal of Dr. Hooker from Kew, botanical science all over the world could receive no severer blow than the deposition of von Mueller from the position he occupies at Melbourne.

WE believe that, in addition to the 4,000*l.* which we recently noted, another 8,000*l.* will be voted in the next French Budget, to be devoted to the preparations necessary for the observation of the forthcoming Transit of Venus.

THE Californian Academy of Sciences experienced a genuine sensation at its meeting on September 9, in welcoming Prof. Agassiz returning from the *Hassler* Expedition, on his first arrival on United States' territory, where he was received by Prof. Davidson, the president of the Academy; Prof. Gillman, the principal of the University of California, Prof. Torrey, of Columbia, the Nestor of American Botanists, and others. In his address on the occasion, Agassiz alluded in the following terms to the growth beneath his eyes of the great Cambridge Museum:—"I went single-handed to Cambridge, to teach natural history, twenty-five years ago. When I delivered my first lecture there was not in the University a single specimen which I could use to illustrate what I had to say. And yet a little band of students, feeling an interest in what they could learn in the lecture-room, and others, thought such a pursuit was worth encouraging, and by-and-by the idea arose that a museum would be of use, and the means were gradually forthcoming, at first sparingly in small contributions, but gradually more liberally in larger sums, until at this moment, after fourteen years only, the museum at Cambridge stands in my estimation without parallel in the world." This he followed up by a statement of what could be done in a new country like California for the advancement of science:—"What would you think of the man who would raise himself his food when he is engaged in the law business or in the medical profession? You would think he was wasting his time. Now I say the scientific man is wasting his time or is obliged to waste his time when he is not provided with the appliances with which he can work, and which he is capable of producing. And I hold that it is one of the duties of those who have the means to help those who have only their head, and who go to work with an empty pocket. So I think that one of your duties, besides fostering and nursing the interest you individually feel for science, is to arouse that general interest in the community, which will make every true patriot, every lover of his State, every philanthropist, every man who has the heart to leave a good repute and an honourable memory, desirous of contributing to your progress." We know there are men in California who both can and will respond to this generous appeal.

PROF. TYNDALL left England on Saturday last by the *Russia* from Liverpool, on a visit to the United States.

THE Council of the Bedford (Ladies') College, Bedford Square, have decided on attempting to introduce some branch of Natural Science into the regular programme of the college studies, and will make a commencement with a class of Vegetable Physiology Mr. A. W. Bennett, who will conduct the class, will also give the Introductory Lecture of the session on Wednesday, October 9th, on "The Place of Natural Science in a Liberal Education."

A VACANCY has occurred in the staff of the Royal Observatory, Greenwich, by the resignation of Mr. James Carpenter, whose services have been transformed to a private engineering firm.

FROM the second report of the Cambridge Natural Science Club we learn that seven meetings have been held during the long vacation, at which the following papers have been read:—"On Turacin," by Mr. R. M. Lewis, B.A., Downing College; "On the old Glaciers of Wales," by Mr. G. E. Paget, Caius College; "On Colour," by Mr. C. T. Whitmell, B.A., B.Sc., Trinity College; "On Sponges," by Mr. A. F. Buxton, Trinity College; "On Thermo-Magnetism," by Mr. J. E. H. Gordon, Caius College; "On *Peronospora infestans*," by Mr. H. M. Martin, M.B., D.Sc., Christ's College; "On Absorption Spectra," by Mr. R. M. Lewis, B.A., Downing College. The club consists of twelve members, of whom seven or eight were in residence during the Long. The attendance at the meetings was good, averaging six or seven members, and two or three visitors. The rule, requesting that members shall give "such practical illustration as the subject admits of," has been very well observed, as almost all the papers have been illustrated by experiments or specimens.

THE opening (public) lecture of the Literary and Scientific Society attached to the Whitechapel Foundation School, was given on Tuesday evening last. Among the lectures to be delivered during the session, will be one on the "Early History of Man," by E. Clodd, F.R.A.S., and on one of the "Divisions of Light," by W. Spottiswoode, F.R.S.

MR. R. PRATT, late Master of the Queen's School of Art, and gold medalist of the Department of Science and Art, has been elected Art-master in the Hartley Institute, Southampton; and Mr. J. R. Brittle, Associate of King's College, London, and late Whitworth Scholar, has been appointed Lecturer on Engineering at the same institution.

THE following classes in connection with the Manchester Mechanics' Institution have been commenced for the season, under the management of Mr. Robert Routledge, B.Sc.:—Applied Mechanics, Steam and the Steam Engine, Acoustics, Light and Heat, Magnetism and Electricity, Organic Chemistry, Inorganic Chemistry, and Practical Chemistry.

THE management of the Islington Youths' Institute has just issued the programme for the winter session. Amongst the various subjects taught at this Institution, those in connection with the Science and Art Department form a conspicuous feature, and six classes in Art and eight in Science are announced. Among these we may mention Drawing (Freehand, Model, and Geometrical), Building Construction, Machine Construction, Geometry (Plane, Practical, and Solid), Electricity and Magnetism, Physical Geography, Physiology, Acoustics, Light and Heat, and Inorganic Chemistry. At the examinations held in May last, out of 129 who competed for the Government prizes, only 13 failed to pass.

THE Council of the Institution of Civil Engineers have awarded the following premiums and prizes for work done during the session 1871-2:—A Telford medal and a Telford premium in books to each of the following gentlemen: Bradford Leslie, for his "Account of the Bridge over the Gorai River, on the Goalundo Extension of the Eastern Bengal Railway;" Carl Siemens, for paper on "Pneumatic Despatch Tubes: the Circuit System;" W. Bell, for paper on "The Stresses of Rigid Arches, Continuous Beams, and Curved Structures;" J. H. Latham, for description of "The Soonkêsala Canal of the Madras Irrigation and Canal Company;" G. Gordon, for paper on "The Value of Water, and its Storage and Distribution in Southern India;" A Telford premium in books to F. A. Abel, F.R.S., for paper on "Explosive Agents applied to Industrial Purposes;" and the same to Bashley Britten, for paper on "The Construction of Heavy Artillery, with reference to Economy of the Mechanical Forces Engaged." The Manby premium in books to C. Andrews, for paper on "The Somerset Dock at Malta." A Miller prize each to Oswald Brown, for paper on "Sewage Utilisation;" A. T. Atchison, for paper on "Railway Bridges of Great Span;" J. Addy, for paper on "The most suitable Materials for, and the best mode of Formation of, the Surfaces of the Streets of Large Towns;" A. E. Preston, for paper on "Wood-Working Machinery;" W. P. Orchard, for paper on "The Education of a Civil Engineer."

WE are informed of the early publication of the first number of the *Telegraphic Journal*, a Monthly Illustrated Review of Electrical Science. It will be edited by the Rev. William Higgs, M.A., sometime assistant to Sir Charles Wheatstone.

THE present autumn has been remarkable for the appearance in scattered localities all over the country of one of our rarest and most beautiful butterflies, the Camberwell Beauty, *Vanessa Antiopa*, very few British specimens of which exist in our cabinets. The *Entomologist* records the capture of upwards of 200 specimens in all parts of the country, from the Channel Islands to Aberdeen. It is very remarkable that they nearly all differ in colouring to a perceptible extent from the Continental variety, the border being creamy white instead of buff-coloured. If they are genuine natives their spasmodic appearance in this manner is very singular, and worthy of careful observation. Several other rare butterflies, especially *Argynnis Lathonia*, *Pieris Daplidice*, and *Colias Hyale*, have also been unusually abundant this season.

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A PLAGUE of butterflies is a rare occurrence. A short time ago, however, the town of Florence was invaded by a prodigious quantity of these insects. All the distance of the Long'arno between the Piazza Manin and the Barriera and in all the adjacent streets the passage was almost obstructed by an extraordinary quantity of butterflies that had swarmed in such thick clouds round the gaslights that the streets were comparatively dark. Fires were immediately lighted by order of the Municipality and by private citizens, in which the butterflies burnt their wings, so that half an hour afterwards one walked upon a layer formed by the bodies of the butterflies an inch thick ! ! ! They were of a whitish colour, and some of the streets appeared as if covered with snow, at least so say the Italian papers.

DR. PATERSON, of Bridge of Allan, writing to the *Scotsman* of September 9, says that on Saturday last he captured in his garden on the flowers of *Lilium auratum* a fine specimen of the Striped Hawk Moth (*Deilephila Livornica*). Dr. Paterson believes this insect has been captured only once before in Scotland.

THE REV. M. J. BERKELEY describes in the *Gardener's Chronicle* a very remarkable instance of luminosity in fungi. It occurred in the mycelium of an unknown species growing on a trunk of spruce or larch, and was so powerful as to make a perfect blaze of white light in the track where the trunk had been dragged, and vividly illuminating everything in contact with it. It gave almost light enough to read the time on the face of a watch, and continued for three days.

THE Brighton Aquarium has lately received two pair of beautiful specimens of the Paradise or Peacock fish. This fish came first from China, and has been acclimatised by M. Carbonnier, the great pisciculturist of Paris; they are very lovely little creatures. Some of their habits are singular; thus M. Carbonnier states that "as the eggs are laid the male carries them away in his mouth, and deposits them in a nest which he builds for them. He will not allow the female to come anywhere near the nest, and if she ventures to approach he swings himself round, and drives her away."

THE Secretary of the U.S. Navy has recently received, by way of Copenhagen, a letter from Captain C. F. Hall, of the *Polaris*, written on the 24th of August, 1871, at Tossak, North Greenland, latitude 73° 21′, longitude 56° 5′ west. Although this is but a few days later than the despatch brought home by the frigate *Congress* nearly a year ago, it renews the assurance of the harmony existing on board the vessel between the members of the expedition, and the perfect satisfaction of all with the equipment and preparations for the coming winter. It is well known that no efforts were spared by the Navy department to render this expedition the most perfect and complete in its equipment of any ever sent to the North; and the success of these endeavours must, therefore, be a source of great gratification to it. Governor Elberg, of the Upernavik district, accompanied the *Polaris* as far as Disco, and brought back the despatches, which have thus been a year in their journey to Washington. Through his help Captain Hall obtained sixty strong, healthy young Esquimaux dogs, and a large supply of reindeer furs, seal-skins, &c. At Upernavik Hans Christian, well known to the readers of Kane's narrative, joined them as hunter and dog-driver, and was accompanied by his wife and three children, who with Joe, and Hannah, and their child, Captain Hall's faithful companions in previous years, made up quite a party. It will be remembered that Captain Hall met the returning Swedish expedition at Holsteinbourg, and that its commander supplied him with charts and copies of such of his notes as promised to be of service to him. Partly in consequence of the suggestions of the commander, Baron Von Otter, and of other scientific men whom he met in Greenland, Captain Hall concluded to abandon the Jones Sound route, and intended to cross Melville Bay to Cape Dudley Digges, and thence to steam directly to Smith Sound, with a view of finding a passage on the west side of the sound from Cape Isabella to Kennedy Channel. Captain Hall speaks very favourably of the steaming qualities of the *Polaris*, her passage having been perfectly satisfactory from port to port. The entire steaming time from New York to Disco was twenty-seven days, seven hours, and thirty minutes.

MR. HULL, of the Irish Geological Survey, has published a letter in the *Dublin Morning Mail* in reference to the quantity of coal available for use in the Irish coal-fields, in which it is stated that the net tonnage available in Ireland is 182,280,000 tons—in Ballycastle, County Antrim, 16,000,000; in Tyrone, 32,900,000; in Queen's County, Kilkenny, and Carlow, 77,580,000; in Tipperary, 25,000,000; in Clare, Limerick, and Cork, 20,000,000; and in Connaught (Arigua district) 10,800,000 tons.

WE are glad to observe from the eighth Report on the Melbourne Observatory that the southern half of the heavens is being observed to good purpose, though both the Board of Visitors and Mr. Ellery think that several improvements in details are much needed in order that the work may be done with anything like sactisfactoriness. The great telescope continues to give increased satisfaction, though there seem to be serious defects in the Magnet House, and a great want of clerical assistance in reducing the great number of stars observed. The number of stars observed up to the period of the report was 48,672, the number reduced being only 36,917. It appears that a large number of drawings of nebulæ and other celestial objects observed with the Great Melbourne Telescope has accumulated, and we earnestly hope that the Board's request to Parliament to supply the funds necessary to publish these may meet with a favourable reply. Naturally the Board and the Government Astronomer express regret that the Eclipse Expedition should have turned out a failure from the unfavourable weather. Still the colony deserves the greatest commendation for the gallant endeavour it made. We are glad to see that vol. iv. of the "Melbourne Astronomical Observations" is now in the press, that a General Catalogue for 1870, containing the results of all the transit work at the observatory, is in preparation, and that in January last the publication of a series of monthly meteorological observations was commenced. Moreover, photographic pictures of the moon are being taken, and promise, we are told, to be both excellent in themselves as works of art, as well as useful in aiding the scientific observations now taking place in Europe. Altogether the Report reflects the greatest credit on Mr. Ellery, the Government Astronomer, and his too limited staff.

THREE slight shocks of earthquake were felt on the evening of July 27 at Valparaiso and at Caracas.

A SLIGHT shock of earthquake was felt at Chopea in Khandeish on the evening of Friday, July 12, at about seven o'clock. The shock lasted about a minute, and appears to have been felt at the same time at Amainer, Dhurrangaon, Dhulia, and Julgaon. Its course was from west to east.

ON the 15th of April a very violent volcanic eruption took place from the volcano Merapi in Java, which had been quiet since 1863. Great destruction of lives and property occurred, many villages being totally destroyed. The outburst was entirely unexpected, and the showers of stones and ashes and the streams of lava were very destructive. At Solo and other places the showers of ashes lasted for three days, and it became so dark that the lamps had to be lit. By the last accounts some 200 dead bodies had been found on one side of the volcano.

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